

The disturbance which became Typhoon Kelly was first detected by satellite imagery on 25 June northwest of Truk Atoll (WMO 91334). During the four-day period which followed, three tropical cyclone formation alerts were issued. This period was marked by often impressive organization on satellite imagery with little or no evidence of a surface circulation center. However, with synoptic data at 291200Z, it became increasingly evident that a surface center had established itself and at 300000Z, the first warning was issued on Tropical Depression 06.

The successful launch of NOAA 7 in June 1981 afforded JTWC the opportunity to receive local afternoon surveillance from a high resolution polar-orbiting satellite platform. At 250447Z, while NOAA 7 was in its 17th orbit, a disturbance was located just northwest of Truk. During the next two days,

satellite imagery showed a continued developing trend. The 270424Z visual imagery from NOAA 7, yielded a Dvorak intensity classification of T2.5 (2.5 is equivalent to 35 kt or 18 m/sec in the classification system). Based on the later data, a Tropical Cyclone Formation Alert was issued at 270800Z for an area north of Ulithi Atoll (WMO 91203). However, during the 16 hours which followed, satellite imagery showed a rapid weakening of the disturbance, and at 280000Z the formation alert was cancelled.

Figure 3-06-1 shows a composite surface streamline analysis of 0000Z data from 25 to 28 June. There was very little evidence of a discernible low-level center near the disturbance which had been observed on satellite imagery during this period. However, the composite analysis does suggest a weak, but pre-existing, low-level center located well west of Ulithi.

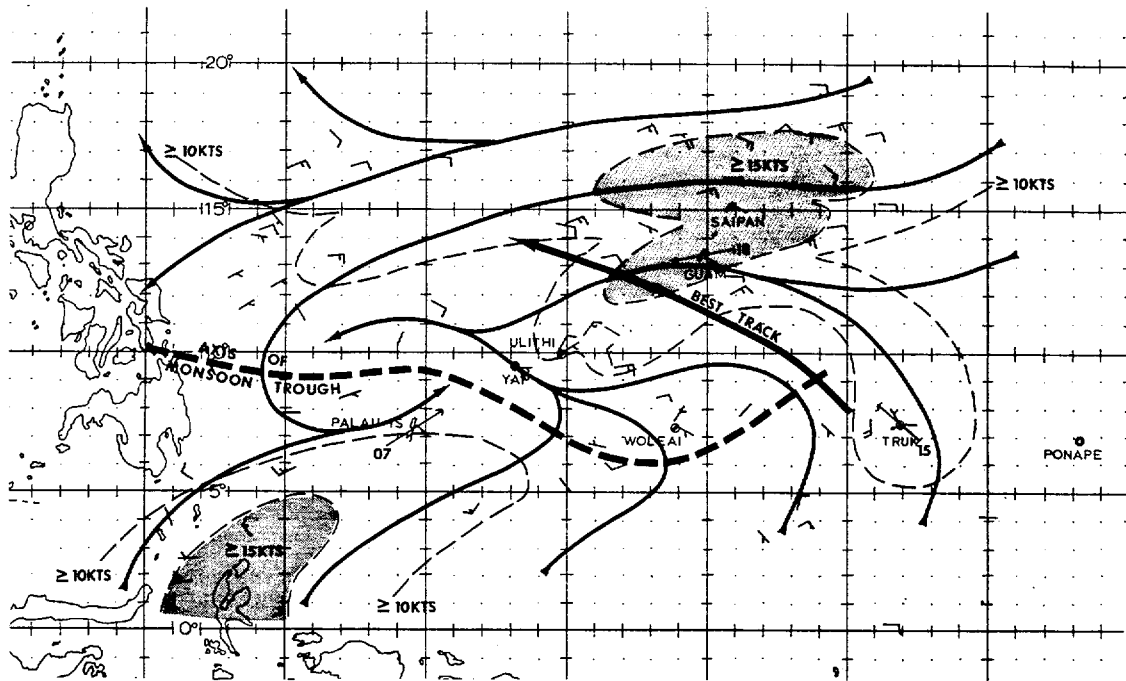


Figure 3-06-1. A composite streamline analysis from surface reports received for 0000Z from 25 to 28 June. During this period, the disturbance which became Kelly moved westward through the Philippine Sea. A lack of organized low-level inflow into the disturbance delayed its development until reaching the area west of 135 east longitude, where a possible pre-existing low-level circulation pattern induced Kelly's subsequent development.

At 281200Z, satellite imagery once again showed an area of increased convection, this time centered near 14N 135E. The 281200Z synoptic reports and subsequent satellite imagery showed improved organization, thus at 282000Z, a Tropical Cyclone Formation Alert was reissued. Figure 3-06-2 is a NOAA 6 image of the disturbance near the time the

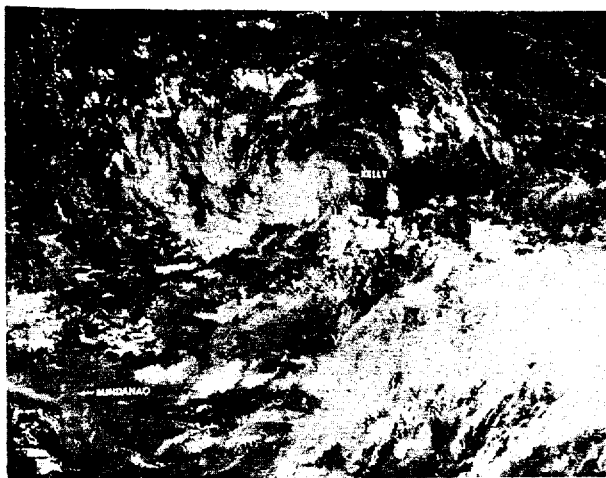


Figure 3-06-2. A weak cloud system center was seen redeveloping on this satellite imagery for 282304Z June. (NOAA 6 visual imagery)

Synoptic observations from reporting stations along the southeastern coast of Luzon and Catanduanes Island (WMO 98447) indicated that TD-06 made landfall at, or near, tropical storm strength, at 301200Z. Thus, at that time TD-06 was upgraded to Tropical Storm Kelly. As Kelly tracked over the central Philippines, the low-level circulation pattern became disrupted and the observed wind speeds lessened, so that by 310000Z, Kelly was downgraded to TD-06. TD-06 tracked directly over Mindoro Island and despite having lost some of its earlier intensity, the combined effects of heavy rains, flooding and mudslides left thousands homeless and nearly 200 dead, Figure 3-06-3 shows TD-06 (Kelly) over Mindoro Island.

Within hours after TD-06 moved into the South China Sea, it regained its low-level circulation pattern and resumed its interrupted intensification trend. At 011800Z, TD-06 was upgraded to Tropical Storm Kelly. (In post-analysis, Kelly first attained tropical storm strength at 300600Z, was downgraded at 301800Z and was upgraded at 010600Z. This is fairly typical of post-

formation alert was issued. During the following 28 hours, further development was evident and the alert was repositioned. At 292241Z, a Dvorak intensity classification of T2.5 was provided by the Det 1, LWW Nimitz Hill, Guam, and the first warning on TD-06 followed at 300000Z.

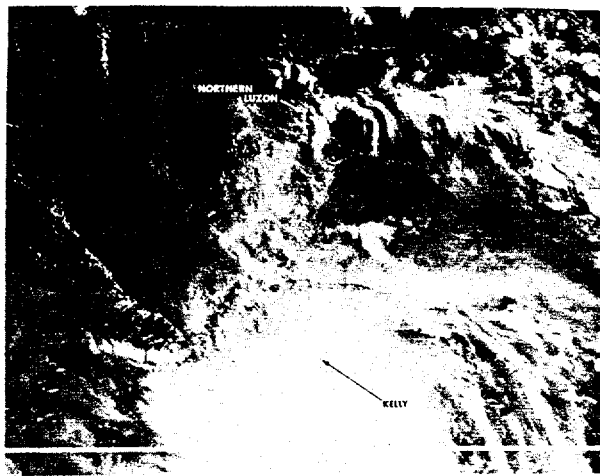


Figure 3-06-3. A weakened Kelly (TD-06) moving through the central Philippines (302359Z June). Although Kelly had lost some of his earlier intensity, the release of energy in heavy precipitation caused extensive flooding and human suffering which cannot be correlated to observed surface winds and pressures. (NOAA 6 visual imagery)

storm analysis since the supporting synoptic data are received at JTWC after the warning has been issued for the synoptic hour; thus, the upgrading and downgrading usually follow on the next warning).

From the first warning on TD-06, an eventual track towards the north was anticipated once the system entered the South China Sea. The 500 mb pattern over Asia was fairly weak and the numerical model forecast series indicated a rather deep trough moving into the region. As Kelly approached the South China Sea, the 010000Z 500 mb hand-analysis (Fig. 3-06-4) showed Kelly in a favorable location for movement to the north. What followed in the first 24 hours, however, was a virtually westward track. Figure 3-06-5 shows the 500 mb pattern just 12 hours later (011200Z). In reconstructing the situation it is evident that the northward current moving around Kelly's eastern periphery actually aided in building the ridge to the north, such that the ridge line kept moving west with Kelly. Eventually this process abated and near 021200Z, Kelly began moving towards the

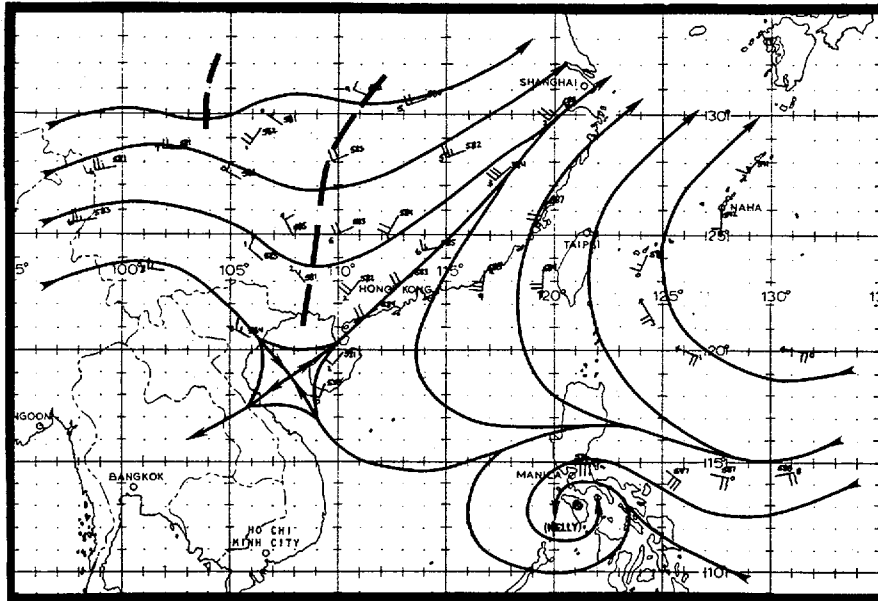


Figure 3-06-4. At 010000Z, a short wave trough is evident extending southward into the Gulf of Tonkin and a southerly flow is well established north of Kelly westward to the trough. Analyzed wind data are a combination of rawinsonde and aircraft reports at the 500 mb level.

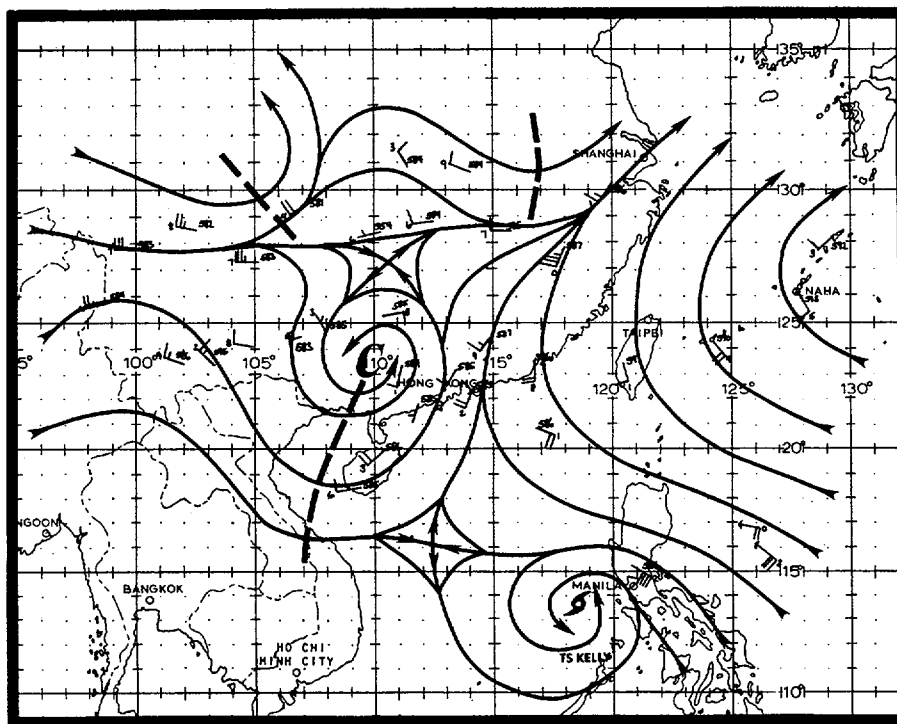


Figure 3-06-5. By 011200Z, the 500 mb analysis shows a fracturing of the short wave northwest of Kelly. Height rises of 20 to 30 meters are common throughout the region. This 12 hour change is striking, however subsequent forecasts continued to forecast eventual northward movement (see Figure 3-06-6).

northwest. Figure 3-06-6 depicts the official JTWC forecasts for Kelly. Note, the persistent trend in virtually every warning issued of Kelly having an increasing northward movement.

At 020000Z (in post-analysis, 021800Z), while moving to the northwest, Kelly was upgraded to typhoon strength. The 030300Z surface observation from the Paracel Islands (WMO 59981) indicated a windshift to southeasterly winds of 74 kt (38 m/sec) and a sea level pressure of 970.8 mb. It was during this period that Kelly is assumed to have reached his maximum intensity of 75 kt (39 m/sec). Subsequent satellite imagery indicated weakening convection with cirrus occasionally masking the eye. By 031800Z, Kelly had reached the southeastern portion of Hai-nan Island and the eye was no longer evident on satellite imagery. After skirting along its southern coastline, Kelly

moved away from Hai-nan and lost much of his strength, resulting in downgrading to tropical storm strength at 040000Z. From Hai-nan to the coast of Vietnam, surface reports were sparse but there is little doubt that Kelly no longer had the low-level winds which were evidenced the preceding day. Interestingly, at 040629Z (Fig. 3-06-7), Kelly briefly displayed a large ragged eye which was observed to be opening to the west at 040900Z. There remains a possibility that Kelly may have regained some strength in the Gulf of Tonkin. However, if Kelly did, it must have been short-lived because hourly reports from Vietnam never indicated any significant or well-organized winds prior to, or after, landfall, which occurred about 100 nm (185 km) south of Hanoi at 041800Z. The last satellite fix received for the remnants of Kelly was at 050000Z, positioned along the Vietnam-Laos border.

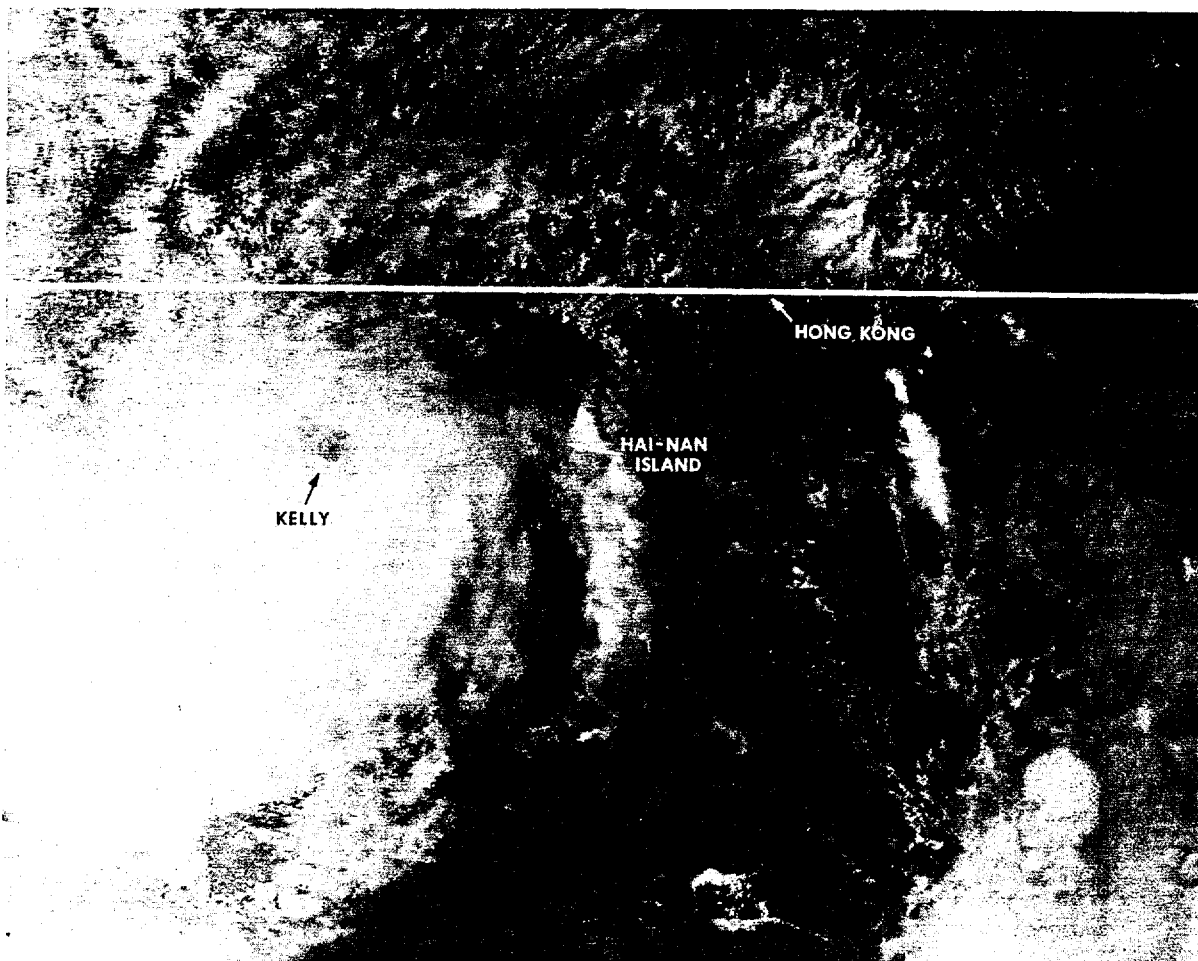


Figure 3-06-7. A ragged eye is apparent on 040629Z July satellite imagery as Kelly moves westward in the Gulf of Tonkin. This eye feature was short-lived and observed winds did not increase during this phase. (NOAA 7 visual imagery)

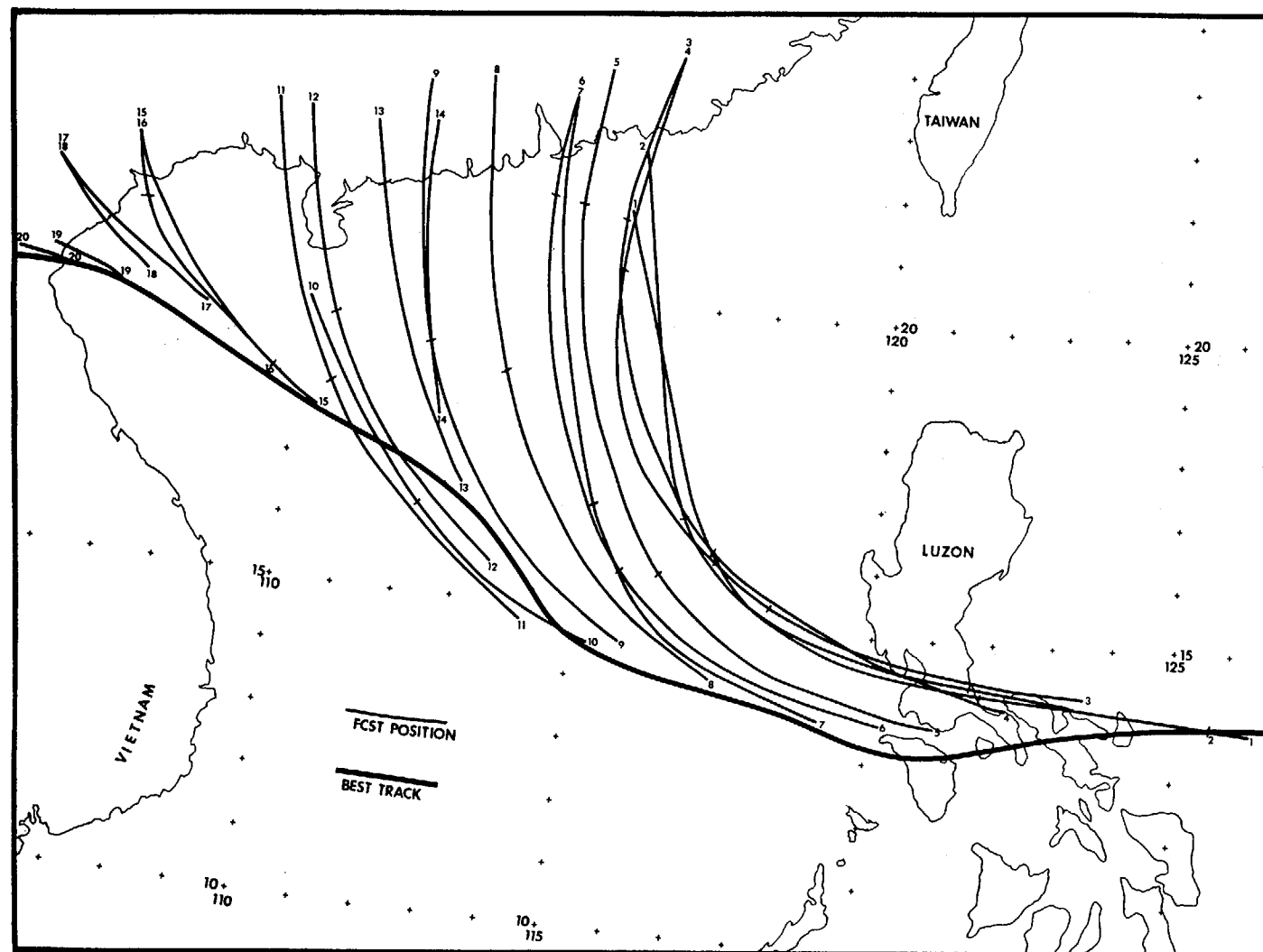


Figure 3-06-6. Official JTWC forecasts versus the final best track for Kelly. Note the obvious inclination to forecast a northward movement throughout Kelly's warning period.